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(54) Novel 7TM receptor (H2CAA71)

(57) Novel 7TM receptor (H2CAA71) polypeptides and polynucleotides and methods for producing such polypeptides by recombinant techniques are disclosed. Also disclosed are methods for utilizing Novel 7TM receptor (H2CAA71) polypeptides and polynucleotides in the design of protocols for the treatment of infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris; myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression, delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome, among others and diagnostic assays for such conditions.

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Description

FIELD OF INVENTION

This invention relates to newly identified polynucleotides, polypeptides encoded by them and to the use of such polynucleotides and polypeptides, and to their production. More particularly, the polynucleotides and polypeptides of the present invention relate to G-protein coupled receptor family, hereinafter referred to as Novel 7TM receptor (H2CAA71). The invention also relates to inhibiting or activating the action of such polynucleotides and polypeptides.

BACKGROUND OF THE INVENTION

It is well established that many medically significant biological processes are mediated by proteins participating in signal transduction pathways that involve G-proteins and/or second messengers, e.g., cAMP (Lefkowitz, Nature, 1991, 351:353-354). Herein these proteins are referred to as proteins participating in pathways with G-proteins or PPG proteins. Some examples of these proteins include the GPC receptors, such as those for adrenergic agents and dopamine (Kobilka, B.K., et al., Proc. Natl Acad. Sci., USA, 1987, 84:46-50; Kobilka, B.K., et al., Science, 1987, 238:650-656; Bunzow, J.R., et al., Nature, 1988, 336:783-787), G-proteins themselves, effector proteins, e.g., phospholipase C, adenyl cyclase, and phosphodiesterase, and actuator proteins, e.g., protein kinase A and protein kinase C (Simon, M.I., et al., Science, 1991, 252:802-8).

For example, in one form of signal transduction, the effect of hormone binding is activation of the enzyme, adenylate cyclase, inside the cell. Enzyme activation by hormones is dependent on the presence of the nucleotide GTP. GTP also influences hormone binding. A G-protein connects the hormone receptor to adenylate cyclase. G-protein was shown to exchange GTP for bound GDP when activated by a hormone receptor. The GTP-carrying form then binds to activated adenylate cyclase. Hydrolysis of GTP to GDP, catalyzed by the G-protein itself, returns the G-protein to its basal, inactive form. Thus, the G-protein serves a dual role, as an intermediate that relays the signal from receptor to effector, and as a clock that controls the duration of the signal.

The membrane protein gene superfamily of G-protein coupled receptors has been characterized as having seven putative transmembrane domains. The domains are believed to represent transmembrane α-helices connected by extracellular or cytoplasmic loops. G-protein coupled receptors include a wide range of biologically active receptors, such as hormone, viral, growth factor and neuroreceptors.

G-protein coupled receptors (otherwise known as 7TM receptors) have been characterized as including these seven conserved hydrophobic stretches of about 20 to 30 amino acids, connecting at least eight divergent hydrophilic loops. The G-protein family of coupled receptors includes dopamine receptors which bind to neuroleptic drugs used for treating psychotic and neurological disorders. Other examples of members of this family include, but are not limited to, calcitonin, adrenergic, endothelin, cAMP, adenosine, muscarinic, acetylcholine, serotonin, histamine, thrombin, kinin, follicle stimulating hormone, opsins, endothelial differentiation gene-1, rhodopsins, odorant, and cytomegalovirus receptors.

Most G-protein coupled receptors have single conserved cysteine residues in each of the first two extracellular loops which form disulfide bonds that are believed to stabilize functional protein structure. The 7 transmembrane regions are designated as TM1, TM2, TM3, TM4, TM5, TM6, and TM7. TM3 has been implicated in signal transduction.

Phosphorylation and lipidation (palmitylation or farnesylation) of cysteine residues can influence signal transduction of some G-protein coupled receptors. Most G-protein coupled receptors contain potential phosphorylation sites within the third cytoplasmic loop and/or the carboxy terminus. For several G-protein coupled receptors, such as the β-adrenoreceptor, phosphorylation by protein kinase A and/or specific receptor kinases mediates receptor desensitization.

For some receptors, the ligand binding sites of G-protein coupled receptors are believed to comprise hydrophilic sockets formed by several G-protein coupled receptor transmembrane domains, said socket being surrounded by hydrophobic residues of the G-protein coupled receptors. The hydrophilic side of each G-protein coupled receptor transmembrane helix is postulated to face inward and form a polar ligand binding site. TM3 has been implicated in several G-protein coupled receptors as having a ligand binding site, such as the TM3 aspartate residue. TM5 serines, a TM6 asparagine and TM6 or TM7 phenylalanines or tyrosines are also implicated in ligand binding.

G-protein coupled receptors can be intracellularly coupled by heterotrimeric G-proteins to various intracellular enzymes, ion channels and transporters (see, Johnson et al., Endoc. Rev., 1989, 10:317-331) Different G-protein α-subunits preferentially stimulate particular effectors to modulate various biological functions in a cell. Phosphorylation of cytoplasmic residues of G-protein coupled receptors have been identified as an important mechanism for the regulation of G-protein coupling of some G-protein coupled receptors. G-protein coupled receptors are found in numerous sites within a mammalian host.

Over the past 15 years, nearly 350 therapeutic agents targeting 7 transmembrane (7TM) receptors have been suc-

cessfully introduced onto the market.

This indicates that these receptors have an established, proven history as therapeutic targets. Clearly there is a need for identification and characterization of further receptors which can play a role in preventing, ameliorating or correcting dysfunctions or diseases, including, but not limited to, infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris; myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression, delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome.

SUMMARY OF THE INVENTION

In one aspect, the invention relates to Novel 7TM receptor (H2CAA71) polypeptides and recombinant materials and methods for their production. Another aspect of the invention relates to methods for using such Novel 7TM receptor (H2CAA71) polypeptides and polynucleotides. Such uses include the treatment of infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris; myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression, delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome, among others. In still another aspect, the invention relates to methods to identify agonists and antagonists using the materials provided by the invention, and treating conditions associated with Novel 7TM receptor (H2CAA71) imbalance with the identified compounds. Yet another aspect of the invention relates to diagnostic assays for detecting diseases associated with inappropriate Novel 7TM receptor (H2CAA71) activity or levels.

DESCRIPTION OF THE INVENTION

Definitions

The following definitions are provided to facilitate understanding of certain terms used frequently herein.

"Novel 7TM receptor (H2CAA71)" refers, among others, to a polypeptide comprising the amino acid sequence set forth in SEQ ID NO:2, or an allelic variant thereof.

"Receptor Activity" or "Biological Activity of the Receptor" refers to the metabolic or physiologic function of said Novel 7TM receptor (H2CAA71) including similar activities or improved activities or these activities with decreased undesirable side-effects. Also included are antigenic and immunogenic activities of said Novel 7TM receptor (H2CAA71).

"Novel 7TM receptor (H2CAA71) gene" refers to a polynucleotide comprising the nucleotide sequence set forth in SEQ ID NO:1 or allelic variants thereof and/or their complements.

"Antibodies" as used herein includes polyclonal and monoclonal antibodies, chimeric, single chain, and humanized antibodies, as well as Fab fragments, including the products of an Fab or other immunoglobulin expression library.

"Isolated" means altered "by the hand of man" from the natural state. If an "isolated" composition or substance occurs in nature, it has been changed or removed from its original environment, or both. For example, a polynucleotide or a polypeptide naturally present in a living animal is not "isolated," but the same polynucleotide or polypeptide separated from the coexisting materials of its natural state is "isolated", as the term is employed herein.

"Polynucleotide" generally refers to any polyribonucleotide or polydeoxribonucleotide, which may be unmodified RNA or DNA or modified RNA or DNA. "Polynucleotides" include, without limitation single- and double-stranded DNA, DNA that is a mixture of single- and double-stranded regions, single- and double-stranded RNA, and RNA that is mixture of single-and double-stranded regions, hybrid molecules comprising DNA and RNA that may be single-stranded or, more typically, double-stranded or a mixture of single- and double-stranded regions. In addition, "polynucleotide" refers to triple-stranded regions comprising RNA or DNA or both RNA and DNA. The term polynucleotide also includes DNAs or RNAs containing one or more modified bases and DNAs or RNAs with backbones modified for stability or for other reasons. "Modified" bases include, for example, tritylated bases and unusual bases such as inosine. A variety of modifications has been made to DNA and RNA; thus, "polynucleotide" embraces chemically, enzymatically or metabolically modified forms of polynucleotides as typically found in nature, as well as the chemical forms of DNA and RNA characteristic of viruses and cells. "Polynucleotide" also embraces relatively short polynucleotides, often referred to as oligonucleotides.

"Polypeptide" refers to any peptide or protein comprising two or more amino acids joined to each other by peptide bonds or modified peptide bonds, i.e., peptide isosteres. "Polypeptide" refers to both short chains, commonly referred

to as peptides, oligopeptides or oligomers, and to longer chains, generally referred to as proteins. Polypeptides may contain amino acids other than the 20 gene-encoded amino acids. "Polypeptides" include amino acid sequences modified either by natural processes, such as posttranslational processing, or by chemical modification techniques which are well known in the art. Such modifications are well described in basic texts and in more detailed monographs, as well as in a voluminous research literature. Modifications can occur anywhere in a polypeptide, including the peptide backbone, the amino acid side-chains and the amino or carboxyl termini. It will be appreciated that the same type of modification may be present in the same or varying degrees at several sites in a given polypeptide. Also, a given polypeptide may contain many types of modifications. Polypeptides may be branched as a result of ubiquitination, and they may be cyclic, with or without branching. Cyclic, branched and branched cyclic polypeptides may result from posttranslation natural processes or may be made by synthetic methods. Modifications include acetylation, acylation, ADP-ribosylation, amidation, covalent attachment of flavin, covalent attachment of a heme moiety, covalent attachment of a nucleotide or nucleotide derivative, covalent attachment of a lipid or lipid derivative, covalent attachment of phosphotidylinositol, cross-linking, cyclization, disulfide bond formation, demethylation, formation of covalent cross-links, formation of cystine, formation of pyroglutamate, formylation, gamma-carboxylation, glycosylation, GPI anchor formation, hydroxylation, iodination, methylation, myristoylation, oxidation, proteolytic processing, phosphorylation, prenylation, racemization, selenoylation, sulfation, transfer-RNA mediated addition of amino acids to proteins such as arginylation, and ubiquitination. See, for instance, PROTEINS - STRUCTURE AND MOLECULAR PROPERTIES, 2nd Ed., T. E. Creighton, W. H. Freeman and Company, New York, 1993 and Wold, F., Posttranslational Protein Modifications: Perspectives and Prospects, pgs. 1-12 in POSTTRANSLATIONAL COVALENT MODIFICATION OF PROTEINS, B. C. Johnson, Ed., Academic Press, New York, 1983; Seifter *et al.*, "Analysis for protein modifications and nonprotein cofactors", *Meth Enzymol* (1990) 182:626-646 and Rattan *et al.*, "Protein Synthesis: Posttranslational Modifications and Aging", *Ann NY Acad Sci* (1992) 663:48-62.

"Variant" as the term is used herein, is a polynucleotide or polypeptide that differs from a reference polynucleotide or polypeptide respectively, but retains essential properties. A typical variant of a polynucleotide differs in nucleotide sequence from another, reference polynucleotide. Changes in the nucleotide sequence of the variant may or may not alter the amino acid sequence of a polypeptide encoded by the reference polynucleotide. Nucleotide changes may result in amino acid substitutions, additions, deletions, fusions and truncations in the polypeptide encoded by the reference sequence, as discussed below. A typical variant of a polypeptide differs in amino acid sequence from another, reference polypeptide. Generally, differences are limited so that the sequences of the reference polypeptide and the variant are closely similar overall and, in many regions, identical. A variant and reference polypeptide may differ in amino acid sequence by one or more substitutions, additions, deletions in any combination. A substituted or inserted amino acid residue may or may not be one encoded by the genetic code. A variant of a polynucleotide or polypeptide may be a naturally occurring such as an allelic variant, or it may be a variant that is not known to occur naturally. Non-naturally occurring variants of polynucleotides and polypeptides may be made by mutagenesis techniques or by direct synthesis.

"Identity" is a measure of the identity of nucleotide sequences or amino acid sequences. In general, the sequences are aligned so that the highest order match is obtained. "Identity" *per se* has an art-recognized meaning and can be calculated using published techniques. See, e.g.: (COMPUTATIONAL MOLECULAR BIOLOGY, Lesk, A.M., ed., Oxford University Press, New York, 1988; BIOCOMPUTING: INFORMATICS AND GENOME PROJECTS, Smith, D.W., ed., Academic Press, New York, 1993; COMPUTER ANALYSIS OF SEQUENCE DATA, PART I, Griffin, A.M., and Griffin, H.G., eds., Humana Press, New Jersey, 1994; SEQUENCE ANALYSIS IN MOLECULAR BIOLOGY, von Heinje, G., Academic Press, 1987; and SEQUENCE ANALYSIS PRIMER, Gribskov, M. and Devereux, J., eds., M Stockton Press, New York, 1991). While there exist a number of methods to measure identity between two polynucleotide or polypeptide sequences, the term "identity" is well known to skilled artisans (Carillo, H., and Lipton, D., *SIAM J Applied Math* (1988) 48:1073). Methods commonly employed to determine identity or similarity between two sequences include, but are not limited to, those disclosed in Guide to Huge Computers, Martin J. Bishop, ed., Academic Press, San Diego, 1994, and Carillo, H., and Lipton, D., *SIAM J Applied Math* (1988) 48:1073. Methods to determine identity and similarity are codified in computer programs. Preferred computer program methods to determine identity and similarity between two sequences include, but are not limited to, GCS program package (Devereux, J., *et al.*, *Nucleic Acids Research* (1984) 12(1):387), BLASTP, BLASTN, FASTA (Atschul, S.F. *et al.*, *J Molec Biol* (1990) 215:403).

As an illustration, by a polynucleotide having a nucleotide sequence having at least, for example, 95% "identity" to a reference nucleotide sequence of SEQ ID NO: 1 is intended that the nucleotide sequence of the polynucleotide is identical to the reference sequence except that the polynucleotide sequence may include up to five point mutations per each 100 nucleotides of the reference nucleotide sequence of SEQ ID NO: 1. In other words, to obtain a polynucleotide having a nucleotide sequence at least 95% identical to a reference nucleotide sequence, up to 5% of the nucleotides in the reference sequence may be deleted or substituted with another nucleotide, or a number of nucleotides up to 5% of the total nucleotides in the reference sequence may be inserted into the reference sequence. These mutations of the reference sequence may occur at the 5 or 3 terminal positions of the reference nucleotide sequence or anywhere

between those terminal positions, interspersed either individually among nucleotides in the reference sequence or in one or more contiguous groups within the reference sequence.

Similarly, by a polypeptide having an amino acid sequence having at least, for example, 95% identity to a reference amino acid sequence of SEQ ID NO:2 is intended that the amino acid sequence of the polypeptide is identical to the reference sequence except that the polypeptide sequence may include up to five amino acid alterations per each 100 amino acids of the reference amino acid of SEQ ID NO: 2. In other words, to obtain a polypeptide having an amino acid sequence at least 95% identical to a reference amino acid sequence, up to 5% of the amino acid residues in the reference sequence may be deleted or substituted with another amino acid, or a number of amino acids up to 5% of the total amino acid residues in the reference sequence may be inserted into the reference sequence. These alterations of the reference sequence may occur at the amino or carboxy terminal positions of the reference amino acid sequence or anywhere between those terminal positions, interspersed either individually among residues in the reference sequence or in one or more contiguous groups within the reference sequence.

Polypeptides of the Invention

In one aspect, the present invention relates to Novel 7TM receptor (H2CAA71) polypeptides. The Novel 7TM receptor (H2CAA71) polypeptides include the polypeptide of SEQ ID NO:2; as well as polypeptides comprising the amino acid sequence of SEQ ID NO:2; and polypeptides comprising the amino acid sequence which have at least 80% identity to that of SEQ ID NO:2 over its entire length, and still more preferably at least 90% identity, and even still more preferably at least 95% identity to SEQ ID NO: 2. Furthermore, those with at least 97-99% are highly preferred. Also included within Novel 7TM receptor (H2CAA71) polypeptides are polypeptides having the amino acid sequence which have at least 80% identity to the polypeptide having the amino acid sequence of SEQ ID NO: 2 over its entire length, and still more preferably at least 90% identity, and even still more preferably at least 95% identity to SEQ ID NO: 2. Furthermore, those with at least 97-99% are highly preferred. Preferably Novel 7TM receptor (H2CAA71) polypeptides exhibit at least one biological activity of the receptor.

The Novel 7TM receptor (H2CAA71) polypeptides may be in the form of the "mature" protein or may be a part of a larger protein such as a fusion protein. It is often advantageous to include an additional amino acid sequence which contains secretory or leader sequences, prosequences, sequences which aid in purification such as multiple histidine residues, or an additional sequence for stability during recombinant production.

Fragments of the Novel 7TM receptor (H2CAA71) polypeptides are also included in the invention. A fragment is a polypeptide having an amino acid sequence that entirely is the same as part, but not all, of the amino acid sequence of the aforementioned Novel 7TM receptor (H2CAA71) polypeptides. As with Novel 7TM receptor (H2CAA71) polypeptides, fragments may be "free-standing," or comprised within a larger polypeptide of which they form a part or region, most preferably as a single continuous region. Representative examples of polypeptide fragments of the invention, include, for example, fragments from about amino acid number 1-20, 21-40, 41-60, 61-80, 81-100, and 101 to the end of Novel 7TM receptor (H2CAA71) polypeptide. In this context "about" includes the particularly recited ranges larger or smaller by several, 5, 4, 3, 2 or 1 amino acid at either extreme or at both extremes.

Preferred fragments include, for example, truncation polypeptides having the amino acid sequence of Novel 7TM receptor (H2CAA71) polypeptides, except for deletion of a continuous series of residues that includes the amino terminus, or a continuous series of residues that includes the carboxyl terminus or deletion of two continuous series of residues, one including the amino terminus and one including the carboxyl terminus. Also preferred are fragments characterized by structural or functional attributes such as fragments that comprise alpha-helix and alpha-helix forming regions, beta-sheet and beta-sheet-forming regions, turn and turn-forming regions, coil and coil-forming regions, hydrophilic regions, hydrophobic regions, alpha amphipathic regions, beta amphipathic regions, flexible regions, surface-forming regions, substrate binding region, and high antigenic index regions. Other preferred fragments are biologically active fragments. Biologically active fragments are those that mediate receptor activity, including those with a similar activity or an improved activity, or with a decreased undesirable activity. Also included are those that are antigenic or immunogenic in an animal, especially in a human.

Preferably, all of these polypeptide fragments retain the biological activity of the receptor, including antigenic activity. Variants of the defined sequence and fragments also form part of the present invention. Preferred variants are those that vary from the referents by conservative amino acid substitutions -- i.e., those that substitute a residue with another of like characteristics. Typical such substitutions are among Ala, Val, Leu and Ile; among Ser and Thr; among the acidic residues Asp and Glu; among Asn and Gln; and among the basic residues Lys and Arg; or aromatic residues Phe and Tyr. Particularly preferred are variants in which several, 5-10, 1-5, or 1-2 amino acids are substituted, deleted, or added in any combination.

The Novel 7TM receptor (H2CAA71) polypeptides of the invention can be prepared in any suitable manner. Such polypeptides include isolated naturally occurring polypeptides, recombinantly produced polypeptides, synthetically produced polypeptides, or polypeptides produced by a combination of these methods. Means for preparing such polypep-

tides are well understood in the art.

Polynucleotides of the Invention

Another aspect of the invention relates to Novel 7TM receptor (H2CAA71) polynucleotides. Novel 7TM receptor (H2CAA71) polynucleotides include isolated polynucleotides which encode the Novel 7TM receptor (H2CAA71) polypeptides and fragments, and polynucleotides closely related thereto. More specifically, Novel 7TM receptor (H2CAA71) polynucleotide of the invention include a polynucleotide comprising the nucleotide sequence set forth in SEQ ID NO:1 encoding a Novel 7TM receptor (H2CAA71) polypeptide of SEQ ID NO: 2, and polynucleotide having the particular sequence of SEQ ID NO:1. Novel 7TM receptor (H2CAA71) polynucleotides further include a polynucleotide comprising a nucleotide sequence that has at least 80% identity to a nucleotide sequence encoding the Novel 7TM receptor (H2CAA71) polypeptide of SEQ ID NO:2 over its entire length, and a polynucleotide that is at least 80% identical to that having SEQ ID NO:1 over its entire length. In this regard, polynucleotides at least 90% identical are particularly preferred, and those with at least 95% are especially preferred. Furthermore, those with at least 97% are highly preferred and those with at least 98-99% are most highly preferred, with at least 99% being the most preferred. Also included under Novel 7TM receptor (H2CAA71) polynucleotides are a nucleotide sequence which has sufficient identity to a nucleotide sequence contained in SEQ ID NO:1 to hybridize under conditions useable for amplification or for use as a probe or marker. The invention also provides polynucleotides which are complementary to such Novel 7TM receptor (H2CAA71) polynucleotides.

Novel 7TM receptor (H2CAA71) of the invention is structurally related to other proteins of the G-protein coupled receptor family, as shown by the results of sequencing the cDNA of Table 1 (SEQ ID NO:1) encoding human Novel 7TM receptor (H2CAA71). The cDNA sequence of SEQ ID NO:1 contains an open reading frame (nucleotide numbers 483 to 2415) encoding a polypeptide of 644 amino acids (SEQ ID NO:2). The amino acid sequence of Table 2 (SEQ ID NO:2) has about 27% identity (using FASTA) in 571 amino acid residues with Bovine follicle stimulating hormone receptor. Houde A 1994 Mol. Reprod. Dev.,39, 127-135. The nucleotide sequence of Table 1 (SEQ ID NO:1) has about 60% identity (using FASTA) in 80 nucleotide residues with Bovine follicle stimulating hormone receptor. Houde A 1994 Mol. Reprod. Dev.,39, 127-135.

Table 1[a]

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   1  GCTTCCATCC TAATACAACT CACTATAGGG CTCGAGCGGC CGCCCGGGCA
  51  GGTGCTTGAC GGAGGTGCCT GTGCACCCCC TCAGCAATCT GCCCACCCTA
 101  CAGGCGCTGA CCCTGGCTCT CAACAAgATC TCAAGCATCC CTgACTTTGC
 151  ATTTACCAAC CTTTCAAGCC TGGTAgTTCT GCATCTTCAT AACAATAAAA
 201  TTAgAAGCCT GAGTCAACAC TGTTTTGATG GACTAgATaA CCTGGAGACC
 251  TTAgACTTGA ATTATAATAA CTTGGGGGAA TTTCCTCAGG CTATTAAAGC
 301  CCTTCCTAGC CTTAAAgAGC TAGGATTTCA TAGTAATTCT ATTTCTGTTA
 351  TCCCTATGGA GCATTTGATG GTAATCCACT CTTAAgAACT ATACATTTGT
 401  ATGATAATCC TCTGTCTTTT GTGGGGAACT CAGCATTTCA CAAttTATCT
 451  GATCTTCATT CCCTAGTCAT TcGTGGTGCA AGCATGGTGC AGCAGTTCCC
 501  CAATCTTACA GGAACTGTCC ACCTGGAAAG TCTGACTTTG ACAGGTACAA
 551  AGATAAGCAG CATACCTAAT AATTTGTGTC AAGAACAAAA GATGCTTAGG
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 601  ACTTTGGACT TGTCTTACAA TAATATAAGA GACCTTCCAA GTTTTAATGG
 651  TTGCCATGCT CTGGAAGAAA TTTCTTTACA GCGTAATCAA ATCTACCAAA
 701  TAAAGGAAGG CACCTTTCAA GGCCTGATAT CTCTAAGGAT TCTAGATCTG
 751  AGTAGAAACC TGATACATGA AATTCACAGT AGAGCTTTTG CCACACTTGG
 801  GCCAATAAct AACcTAGAtG TAAGTTTCAA tGAATTAACT TCcTTTCCtA
 851  CGGAAGGCCt GAATGGGcTA AATCAACTGA AACTGGTGGG CAACTTCAAG
 901  cTGAAAGAAG CCTTAGCAGC AAAAGACTTt GTTAACCTCa GGTCTTTATC
 951  AGTACCATAT GCTTATCAGT GCTGTGCATT TtGGGGTTGT GAcTCTTATG
1001  CAAATTTAAA CACAGAAGAT AACAGCCTCC AGGACCACAG TGTGGCACAG
1051  GAGAAAGGTA CTGCTGATGC AGCAAATGTC ACAAGCACTC TTGAAAATGA
1101  AGAACATAGT CAAATAATTA TCCATTGTAC ACCTTCAACA GGTGCTTTTA
1151  AGCCCTGTGA ATATTTACTG GGAAGCTGGA TGATTCGTCT TACTGTGTGG
1201 TTCATTTTCT TGGTTGCATT ATTTTTCAAC CTGCTTGTTA TTTTAACAAC
1251  ATTTGCATCT TGTACATCAC TGCCTTCGTC CAAATTGTTT ATAGGCTTGA
1301  TTTCTGTGTC TAACTTATTC ATGGGAATCT ATACTGGCAT CCTAACTTTT
1351  CTTGATGCTG TGTCCTGGGG CAGATTCGCT GAATTTGGCA TTTGGTGGGA
1401  AACTGGCAGT GGCTGCAAAG TAACTGGGTT TCTTGCAgTT TTCTCCTCAG
1451  AAAGTGCCAT ATTTTTATTA ATGCTAgCAA CTGTCGAAAG AAgCTTATCT
1501  GCAAAAGATA TAATGAAAAA TGGGAAGAGC AATCATCTCA AACAGTTCCG
1551  GGTTGCTGCC CTTTTGGCTT TCCTAGGTGC TACAGTAACA GGCTGTTTTC
1601  CCCTTTTCCA TAGAGGGGAA TATTCTGCAT CACCCCTTTG TTTGCCATTT
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1651  CCTACAGGTG AAACGCCATC ATTAGGATTC ACTGTAACGT TAGTGCTATT
1701  AAACTCACTA GCATTTTTAT TAATGGCCGT TATCTACACT AAGCTATACT
1751  GCAACTTGGA AAAAGAGGAC CTCTCAGAAA ACTCACAATC TAGCATGATT
1801  AAGCATGTCG CTTGGCTAAT CTTCACCAAT TGCATCTTTT TCTGCCCTGT
1851  GGCGTTTTTT TCATTTGCAC CATTGATCAC TGCAATCTCT ATCAGCCCCG
1901  AAATAATGAA GTCTGTTACT CTGATATTTT TTCCATTGCC TGCTTGCCTG
1951  AATCCAGTCC TGTATGTTTT CTTCAACCCA AAGTTTAAAG AAGACTGGAA
2001  GTTACTGAAG CGACGTGTTA CCAAGAAAAG TGGATCAGTT TCAGTTTCCA
2051  TCAGTAGCCA AGGTGGTTGT CTGGAACAGG ATTTCTACTA CGACTGTGGC
2101  ATGTACTCAC ATTTGCAGGG CAACCTGACT GTTTGCGACT GCTGCGAATC
2151  GTTTCTTTTA ACAAAGCCAG TATCATGCAA ACACTTGATA AAATCACACA
2201  GCTGTCCTGC ATTGGCAGTG GCTTCTTGCC AAAGACCTGA GGGCTACTGG
2251  TCCGACTGTG GCACACAGTC GGCCCACTCT GATTATGCAG ATGAAGAAGA
2301  TTCCTTTGTC TCAGACAGTT CTGACCAGGT GCAGGCCTGT GGACGAGCCT
2351  GCTTCTACCA GAGTAGAGGA TTCCCTTTGG TGCGCTATGC TTACAATCTA
2401  CCAAGAGTTA AAGACTGAAC TACTGTGTGT GTAACCGTTT CCCCCGTCAA
2451  CCAAAATCAG TGTTTATAGA GTGAACCCTA TTCTCATCTT TCATCTGGGA
2501  AGCACTTCTG TAATCACTGC CTGGTGTCAC TTAGAAGAAG GAGAGGTGGC
2551  AGTTTATTTC TCAAACCAGT CATTTTCAAA GAACAGGTGC CTAAATTATA
2601  AATTGGTGAA AAATGCAATG TCCAAGCAAT GTATGATCTG TTTGAAACAA
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2651  ATATATGACT TGAAAAGGAT CTTAGGTGTA GTAGAGCAAT ATAATGTTAG

2701  TTTTTTCTGA TCCATAAGAA GCAAATTTAT ACCTATTTGT GTATTAAGCA

2751  CAAGATAAAG AACAGCTGTT AATATTTTTT AAAAATCTAT TTTAAAATGT

2801  GATTTTCTAT AACTGAAGAA AATATCTTGC TAATTTTACC TAATGTTTCA

2851  TCCTTAATCT CAGGACAACT TACTGCAGGG CCAAAAAAGG GACTGTCCCA

2901  GCTAGAACTG TGAGAGTATA CATAGGCATT ACTTTATTAT GTTTTCACTT

2951  GCCATCCTTG ACATAAGAGA ACTATAAATT TTGTTTAAGC AATTTATAAA

3001  TCTAAAACCT GAAGATGTTT TTAAAACAAT ATTAACAGCT GTTAGGTTAA

3051  AAAAATAGCT GGACATTTGT TTTCAGTCAT TATACATTGC TTTGGTCCAA

3101  TCAGTAATTT TTTCTTAAGT GTTTTGTGAT TACACTACTA GAAAAAAAGT

3151  AAAAGGCTAA TTGCTGTGTG GGTTTAGTCG ATTTGGCTAA ACTACTAACT

3201  AATGTGGGGG TTTAATAGTA TCTGAGGGAT TTGGTGGCTT CATGTAATGT

3251  TCTCATTAAT GAATACTTCC TAATATCGTT GGCTCTACTA ATATTTTCCA

3301  ATTTGCTGGG ATGTCACCTA GCAATAGCTT GGATTATATA GAAAGTAAAC

3351  TGTGGTCAAT ACTTGCATTT AATTAGACGA AACGGGGAGT AATTATGACA

3401  CGAAGTACTT ATGTTTATTT CTTAGTGAGC TGGATTATCT TGAACCTGTG

3451  CTATTAAATG GAAATTTCCA TACATCTTCC CCATACTATT TTTTATAAAA

3501  GAGCCTATTC AATAGCTCAG AGGTTGAACT CTGGTTAAAC AAGATAATAT

3551  GTTATTAATA AAAATAGAAG AAGAAAGAAT AAAGCTTAGT CCTGTGTCTT

3601  TAAAAATTAA AAATTTTACT TGATTCCCAT CTATGGGCTT TAGACCTATT

3651  ACTGGGTGGA GTCTTAAAGT TATAATTGTT CAATATGTTT TTTGAACAGT
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3701  GTGCTAAATC AATAGCAAAC CCACTGCCAT ATTAGTTATT CTGAATATAC

3751  TAAAAAAATC CAGCTAGATT GCAGTTTAAT AATTAAACTG TACATACTGT

3801  GCATATAATG AATTTTTATC TTATGTAAAT TATTTTTAGA ACACAAGTTG

3851  GGAAATGTGG CTTCTGTTCA TTTCGTTTAA TTAAAGCTAC CTCCTAAACT

3901  ATAGTGGCTG CCAGTAGCAG ACTGTTAAAT TGTGGTTTAT ATACTTTTTG

3951  CATTGTAAAT AGTCTTTGTT GTACATTGTC AGTGTAATAA AAACAGAATC

4001  TTTGTATATC AAAATCATGT AGTTTGTATA AAATGTGGGA AGGATTTATT

4051  TACAGTGTGT TGTAATTTTG TAAGGCCAAC TATTTACAAG TTTTAAAAAT

4101  TGCTATCATG TATATTTACA CATCTGATAA ATATTAAATC ATAACTTGGT

4151  AAGAAACTCC TAATTAAAAG GTTTTTTCCA AAAAAAAAAA AAAAAAAAAA

4201  AAA
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[a] A nucleotide sequence of a human Novel 7TM receptor (H2CAA71) (SEQ ID NO: 1).

Table 2[b]

```
  1   MVQQFPNLTG TVHLESLTLT GTKISSIPNN LCQEQKMLRT LDLSYNNIRD

 51   LPSFNGCHAL EEISLQRNQI YQIKEGTFQG LISLRILDLS RNLIHEIHSR

101   AFATLGPITN LDVSFNELTS FPTEGLNGLN QLKLVGNFKL KEALAAKDFV

151   NLRSLSVPYA YQCCAFWGCD SYANLNTEDN SLQDHSVAQE KGTADAANVT

201   STLENEEHSQ IIIHCTPSTG AFKPCEYLLG SWMIRLTVWF IFLVALFFNL

251   LVILTTFASC TSLPSSKLFI GLISVSNLFM GIYTGILTFL DAVSWGRFAE
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301  FGIWWETGSG CKVTGFLAVF SSESAIFLLM LATVERSLSA KDIMKNGKSN

351  HLKQFRVAAL LAFLGATVTG CFPLFHRGEY SASPLCLPFP TGETPSLGFT

401  VTLVLLNSLA FLLMAVIYTK LYCNLEKEDL SENSQSSMIK HVAWLIFTNC

451  IFFCPVAFFS FAPLITAISI SPEIMKSVTL IFFPLPACLN PVLYVFFNPK

501  FKEDWKLLKR RVTKKSGSVS VSISSQGGCL EQDFYYDCGM YSHLQGNLTV

551  CDCCESFLLT KPVSCKHLIK SHSCPALAVA SCQRPEGYWS DCGTQSAHSD

601  YADEEDSFVS DSSDQVQACG RACFYQSRGF PLVRYAYNLP RVKD
```

An amino acid sequence of a human Novel 7TM receptor (H2CAA71) (SEQ ID NO: 2).

One polynucleotide of the present invention encoding Novel 7TM receptor (H2CAA71) may be obtained using standard cloning and screening, from a cDNA library derived from mRNA in cells of Human placenta using the expressed sequence tag (EST) analysis (Adams, M.D., *et al. Science* (1991) 252:1651-1656; Adams, M.D. *et al., Nature,* (1992) *355*:632-634; Adams, M.D., *et al., Nature* (1995) 377 Supp:3-174). Polynucleotides of the invention can also be obtained from natural sources such as genomic DNA libraries or can be synthesized using well known and commercially available techniques.

The nucleotide sequence encoding Novel 7TM receptor (H2CAA71) polypeptide of SEQ ID NO:2 may be identical to the polypeptide encoding sequence contained in Table 1 (nucleotide number 483 to 2415 of SEQ ID NO:1), or it may be a sequence, which as a result of the redundancy (degeneracy) of the genetic code, also encodes the polypeptide of SEQ ID NO:2.

When the polynucleotides of the invention are used for the recombinant production of Novel 7TM receptor (H2CAA71) polypeptide, the polynucleotide may include the coding sequence for the mature polypeptide or a fragment thereof, by itself; the coding sequence for the mature polypeptide or fragment in reading frame with other coding sequences, such as those encoding a leader or secretory sequence, a pre-, or pro- or prepro- protein sequence, or other fusion peptide portions. For example, a marker sequence which facilitates purification of the fused polypeptide can be encoded. In certain preferred embodiments of this aspect of the invention, the marker sequence is a hexa-histidine peptide, as provided in the pQE vector (Qiagen, Inc.) and described in Gentz *et al., Proc Natl Acad Sci USA* (1989) 86:821-824, or is an HA tag. The polynucleotide may also contain non-coding 5' and 3' sequences, such as transcribed, non-translated sequences, splicing and polyadenylation signals, ribosome binding sites and sequences that stabilize mRNA.

Further preferred embodiments are polynucleotides encoding Novel 7TM receptor (H2CAA71) variants comprising the amino acid sequence of Novel 7TM receptor (H2CAA71) polypeptide of Table 2 (SEQ ID NO:2) in which several, 5-10, 1-5, 1-3, 1-2 or 1 amino acid residues are substituted, deleted or added, in any combination.

The present invention further relates to polynucleotides that hybridize to the herein above-described sequences. In this regard, the present invention especially relates to polynucleotides which hybridize under stringent conditions to the herein above-described polynucleotides. As herein used, the term "stringent conditions" means hybridization will occur only if there is at least 95% and preferably at least 97% identity between the sequences.

Polynucleotides of the invention, which are identical or sufficiently identical to a nucleotide sequence contained in SEQ ID NO:1 or a fragment thereof, may be used as hybridization probes for cDNA and genomic DNA, to isolate full-length cDNAs and genomic clones encoding Novel 7TM receptor (H2CAA71) and to isolate cDNA and genomic clones of other genes that have a high sequence similarity to the Novel 7TM receptor (H2CAA71) gene. Such hybridization techniques are known to those of skill in the art. Typically these nucleotide sequences are 80% identical, preferably 90% identical, more preferably 95% identical to that of the referent. The probes generally will comprise at least 15 nucleotides. Preferably, such probes will have at least 30 nucleotides and may have at least 50 nucleotides. Particularly preferred probes will range between 30 and 50 nucleotides.

In one embodiment, to obtain a polynucleotide encoding Novel 7TM receptor (H2CAA71) polypeptide comprises the steps of screening an appropriate library under stingent hybridization conditions with a labeled probe having the SEQ ID NO: 1 or a fragment thereof; and isolating full-length cDNA and genomic clones containing said polynucleotide sequence. Thus in another aspect, Novel 7TM receptor (H2CAA71) polynucleotides of the present invention further include a nucleotide sequence comprising a nucleotide sequence that hybridizes under stringent conditions to a nucleotide sequence having SEQ ID NO: 1 or a fragment thereof. Also included with Novel 7TM receptor (H2CAA71) polypeptides are polypeptides comprising amino acid sequences encoded by a nucleotide sequence obtained by the above hybridization condition. Such hybridization techniques are well known to those of skill in the art. Stringent hybridization conditions are as defined above or alternatively conditions under overnight incubation at 42°C in a solution comprising: 50% formamide, 5xSSC (150mM NaCl, 15mM trisodium citrate), 50 mM sodium phosphate (pH7.6), 5x Denhardt's solution, 10 % dextran sulfate, and 20 microgram/ml denatured, sheared salmon sperm DNA, followed by washing the filters in 0.1x SSC at about 65°C.

The polynucleotides and polypeptides of the present invention may be employed as research reagents and materials for discovery of treatments and diagnostics to animal and human disease.

Vectors, Host Cells, Expression

The present invention also relates to vectors which comprise a polynucleotide or polynucleotides of the present invention, and host cells which are genetically engineered with vectors of the invention and to the production of polypeptides of the invention by recombinant techniques. Cell-free translation systems can also be employed to produce such proteins using RNAs derived from the DNA constructs of the present invention.

For recombinant production, host cells can be genetically engineered to incorporate expression systems or portions thereof for polynucleotides of the present invention. Introduction of polynucleotides into host cells can be effected by methods described in many standard laboratory manuals, such as Davis et al., *BASIC METHODS IN MOLECULAR BIOLOGY* (1986) and Sambrook et al., *MOLECULAR CLONING: A LABORATORY MANUAL*, 2nd Ed., Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y. (1989) such as calcium phosphate transfection, DEAE-dextran mediated transfection, transvection, microinjection, cationic lipid-mediated transfection, electroporation, transduction, scrape loading, ballistic introduction or infection.

Representative examples of appropriate hosts include bacterial cells, such as streptococci, staphylococci, *E. coli*, *Streptomyces* and *Bacillus subtilis* cells; fungal cells, such as yeast cells and *Aspergillus* cells; insect cells such as *Drosophila* S2 and *Spodoptera* Sf9 cells; animal cells such as CHO, COS, HeLa, C127, 3T3, BHK, HEK 293 and Bowes melanoma cells; and plant cells.

A great variety of expression systems can be used. Such systems include, among others, chromosomal, episomal and virus-derived systems, e.g., vectors derived from bacterial plasmids, from bacteriophage, from transposons, from yeast episomes, from insertion elements, from yeast chromosomal elements, from viruses such as baculoviruses, papova viruses, such as SV40, vaccinia viruses, adenoviruses, fowl pox viruses, pseudorabies viruses and retroviruses, and vectors derived from combinations thereof, such as those derived from plasmid and bacteriophage genetic elements, such as cosmids and phagemids. The expression systems may contain control regions that regulate as well as engender expression. Generally, any system or vector suitable to maintain, propagate or express polynucleotides to produce a polypeptide in a host may be used. The appropriate nucleotide sequence may be inserted into an expression system by any of a variety of well-known and routine techniques, such as, for example, those set forth in Sambrook *et al.*, *MOLECULAR CLONING, A LABORATORY MANUAL* (*supra*).

For secretion of the translated protein into the lumen of the endoplasmic reticulum, into the periplasmic space or into the extracellular environment, appropriate secretion signals may be incorporated into the desired polypeptide. These signals may be endogenous to the polypeptide or they may be heterologous signals.

If the Novel 7TM receptor (H2CAA71) polypeptide is to be expressed for use in screening assays, generally, it is preferred that the polypeptide be produced at the surface of the cell. In this event, the cells may be harvested prior to use in the screening assay. If Novel 7TM receptor (H2CAA71) polypeptide is secreted into the medium, the medium can be recovered in order to recover and purify the polypeptide; if produced intracellularly, the cells must first be lysed before the polypeptide is recovered.

Novel 7TM receptor (H2CAA71) polypeptides can be recovered and purified from recombinant cell cultures by well-known methods including ammonium sulfate or ethanol precipitation, acid extraction, anion or cation exchange chromatography, phosphocellulose chromatography, hydrophobic interaction chromatography, affinity chromatography, hydroxylapatite chromatography and lectin chromatography. Most preferably, high performance liquid chromatography is employed for purification. Well known techniques for refolding proteins may be employed to regenerate active conformation when the polypeptide is denatured during isolation and or purification.

Diagnostic Assays

This invention also relates to the use of Novel 7TM receptor (H2CAA71) polynucleotides for use as diagnostic reagents. Detection of a mutated form of Novel 7TM receptor (H2CAA71) gene associated with a dysfunction will provide a diagnostic tool that can add to or define a diagnosis of a disease or susceptibility to a disease which results from under-expression, over-expression or altered expression of Novel 7TM receptor (H2CAA71). Individuals carrying mutations in the Novel 7TM receptor (H2CAA71) gene may be detected at the DNA level by a variety of techniques.

Nucleic acids for diagnosis may be obtained from a subject's cells, such as from blood, urine, saliva, tissue biopsy or autopsy material. The genomic DNA may be used directly for detection or may be amplified enzymatically by using PCR or other amplification techniques prior to analysis. RNA or cDNA may also be used in similar fashion. Deletions and insertions can be detected by a change in size of the amplified product in comparison to the normal genotype. Point mutations can be identified by hybridizing amplified DNA to labeled Novel 7TM receptor (H2CAA71) nucleotide sequences. Perfectly matched sequences can be distinguished from mismatched duplexes by RNase digestion or by differences in melting temperatures. DNA sequence differences may also be detected by alterations in electrophoretic mobility of DNA fragments in gels, with or without denaturing agents, or by direct DNA sequencing. See, e.g., Myers *et al., Science* (1985) 230:1242. Sequence changes at specific locations may also be revealed by nuclease protection assays, such as RNase and S1 protection or the chemical cleavage method. See Cotton *et al., Proc Natl Acad Sci USA* (1985) 85: 4397-4401. In another embodiment, an array of oligonucleotides probes comprising Novel 7TM receptor (H2CAA71) nucleotide sequence or fragments thereof can be constructed to conduct efficient screening of e.g., genetic mutations. Array technology methods are well known and have general applicability and can be used to address a variety of questions in molecular genetics including gene expression, genetic linkage, and genetic variability. (See for example: M.Chee et al., Science, Vol 274, pp 610-613 (1996)).

The diagnostic assays offer a process for diagnosing or determining a susceptibility to infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris; myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression, delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome through detection of mutation in the Novel 7TM receptor (H2CAA71) gene by the methods described.

In addition, infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris; myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome, can be diagnosed by methods comprising determining from a sample derived from a subject an abnormally decreased or increased level of Novel 7TM receptor (H2CAA71) polypeptide or Novel 7TM receptor (H2CAA71) mRNA. Decreased or increased expression can be measured at the RNA level using any of the methods well known in the art for the quantitation of polynucleotides, such as, for example, PCR, RT-PCR, RNase protection, Northern blotting and other hybridization methods. Assay techniques that can be used to determine levels of a protein, such as an Novel 7TM receptor (H2CAA71), in a sample derived from a host are well-known to those of skill in the art. Such assay methods include radioimmunoassays, competitive-binding assays, Western Blot analysis and ELISA assays.

Chromosome Assays

The nucleotide sequences of the present invention are also valuable for chromosome identification. The sequence is specifically targeted to and can hybridize with a particular location on an individual human chromosome. The mapping of relevant sequences to chromosomes according to the present invention is an important first step in correlating those sequences with gene associated disease. Once a sequence has been mapped to a precise chromosornal location, the physical position of the sequence on the chromosome can be correlated with genetic map data. Such data are found, for example, in V. McKusick, Mendelian Inheritance in Man (available on line through Johns Hopkins University Welch Medical Library). The relationship between genes and diseases that have been mapped to the same chromosomal region are then identified through linkage analysis (coinheritance of physically adjacent genes).

The differences in the cDNA or genomic sequence between affected and unaffected individuals can also be determined. If a mutation is observed in some or all of the affected individuals but not in any normal individuals, then the mutation is likely to be the causative agent of the disease.

Antibodies

The polypeptides of the invention or their fragments or analogs thereof or cells expressing them can also be used as immunogens to produce antibodies immunospecific for the Novel 7TM receptor (H2CAA71) polypeptides. The term "immunospecific" means that the antibodies have substantiall greater affinity for the polypeptides of the invention than their affinity for other related polypeptides in the prior art.

Antibodies generated against the Novel 7TM receptor (H2CAA71) polypeptides can be obtained by administering the polypeptides or epitope-bearing fragments, analogs or cells to an animal, preferably a nonhuman, using routine protocols. For preparation of monoclonal antibodies, any technique which provides antibodies produced by continuous cell line cultures can be used. Examples include the hybridoma technique (Kohler, G. and Milstein, C., *Nature* (1975) 256:495-497), the trioma technique, the human B-cell hybridoma technique (Kozbor *et al.*, *Immunology Today* (1983) 4:72) and the EBV-hybridoma technique (Cole *et al.*, MONOCLONAL ANTIBODIES AND CANCER THERAPY, pp. 77-96, Alan R. Liss, Inc., 1985).

Techniques for the production of single chain antibodies (U.S. Patent No. 4,946,778) can also be adapted to produce single chain antibodies to polypeptides of this invention. Also, transgenic mice, or other organisms including other mammals, may be used to express humanized antibodies.

The above-described antibodies may be employed to isolate or to identify clones expressing the polypeptide or to purify the polypeptides by affinity chromatography.

Antibodies against Novel 7TM receptor (H2CAA71) polypeptides may also be employed to treat infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris; myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression, delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome, among others.

Vaccines

Another aspect of the invention relates to a method for inducing an immunological response in a mammal which comprises inoculating the mammal with Novel 7TM receptor (H2CAA71) polypeptide, or a fragment thereof, adequate to produce antibody and/or T cell immune response to protect said animal from infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris; myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression, delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome, among others. Yet another aspect of the invention relates to a method of inducing immunological response in a mammal which comprises, delivering Novel 7TM receptor (H2CAA71) polypeptide via a vector directing expression of Novel 7TM receptor (H2CAA71) polynucleotide *in vivo* in order to induce such an immunological response to produce antibody to protect said animal from diseases.

Further aspect of the invention relates to an immunological/vaccine formulation (composition) which, when introduced into a mammalian host, induces an immunological response in that mammal to a Novel 7TM receptor (H2CAA71) polypeptide wherein the composition comprises a Novel 7TM receptor (H2CAA71) polypeptide or Novel 7TM receptor (H2CAA71) gene. The vaccine formulation may further comprise a suitable carrier. Since Novel 7TM receptor (H2CAA71) polypeptide may be broken down in the stomach, it is preferably administered parenterally (including subcutaneous, intramuscular, intravenous, intradermal etc. injection). Formulations suitable for parenteral administration include aqueous and non-aqueous sterile injection solutions which may contain anti-oxidants, buffers, bacteriostats and solutes which render the formulation instonic with the blood of the recipient; and aqueous and non-aqueous sterile suspensions which may include suspending agents or thickening agents. The formulations may be presented in unit-dose or multi-dose containers, for example, sealed ampoules and vials and may be stored in a freeze-dried condition requiring only the addition of the sterile liquid carrier immediately prior to use. The vaccine formulation may also include adjuvant systems for enhancing the immunogenicity of the formulation, such as oil-in water systems and other systems known in the art. The dosage will depend on the specific activity of the vaccine and can be readily determined by routine experimentation.

Screening Assays

The Novel 7TM receptor (H2CAA71) polypeptide of the present invention may be employed in a screening process for compounds which bind the receptor and which activate (agonists) or inhibit activation of (antagonists) the receptor polypeptide of the present invention. Thus, polypeptides of the invention may also be used to assess the binding of

small molecule substrates and ligands in, for example, cells, cell-free preparations, chemical libraries, and natural product mixtures. These substrates and ligands may be natural substrates and ligands or may be structural or functional mimetics. See Coligan *et al.*, *Current Protocols in Immunology* 1(2):Chapter 5 (1991).

Navel 7TM receptor (H2CAA71) polypeptides are responsible far many biological functions, including many pathologies. Accordingly, it is desirous to find compounds and drugs which stimulate Novel 7TM receptor (H2CAA71) on the one hand and which can inhibit the function of Novel 7TM receptor (H2CAA71) on the other hand. In general, agonists are employed for therapeutic and prophylactic purposes for such conditions as infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris; myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression, delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome. Antagonists may be employed for a variety of therapeutic and prophylactic purposes for such conditions as infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris; myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression, delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome.

In general, such screening procedures involve producing appropriate cells which express the receptor polypeptide of the present invention on the surface thereof. Such cells include cells from mammals, yeast, *Drosophila* or *E. coli*. Cells expressing the receptor (or cell membrane containing the expressed receptor) are then contacted with a test compound to observe binding, or stimulation or inhibition of a functional response.

One screening technique includes the use of cells which express receptor of this invention (for example, transfected CHO cells) in a system which measures extracellular pH or intracellular calcium changes caused by receptor activation. In this technique, compounds may be contacted with cells expressing the receptor polypeptide of the present invention. A second messenger response, e.g., signal transduction, pH changes, or changes in calcium level, is then measured to determine whether the potential compound activates or inhibits the receptor.

Another method involves screening for receptor inhibitors by determining inhibition or stimulation of receptor-mediated cAMP and/or adenylate cyclase accumulation. Such a method involves transfecting a eukaryotic cell with the receptor of this invention to express the receptor on the cell surface. The cell is then exposed to potential antagonists in the presence of the receptor of this invention. The amount of cAMP accumulation is then measured. If the potential antagonist binds the receptor, and thus inhibits receptor binding, the levels of receptor-mediated cAMP, or adenylate cyclase, activity will be reduced or increased.

Another methods for detecting agonists or antagonists for the receptor of the present invention is the yeast based technology as described in U.S. Patent 5,482,835 which is incorporated herein by reference..

The assays may simply test binding of a candidate compound wherein adherence to the cells bearing the receptor is detected by means of a label directly or indirectly associated with the candidate compound or in an assay involving competition with a labeled competitor. Further, these assays may test whether the candidate compound results in a signal generated by activation of tile receptor, using detection systems appropriate to the cells bearing the receptor at their surfaces. Inhibitors of activation are generally assayed in the presence of a known agonist and the effect on activation by the agonist by the presence of the candidate compound is observed.

The Novel 7TM receptor (H2CAA71) cDNA, protein and antibodies to the protein may also be used to configure assays for detecting the effect of added compounds on the production of Novel 7TM receptor (H2CAA71) mRNA and protein in cells. For example, an ELISA may be constructed for measuring secreted or cell associated levels of Novel 7TM receptor (H2CAA71) protein using monoclonal and polyclonal antibodies by standard methods known in the art, and this can be used to discover agents which may inhibit or enhance the production of Novel 7TM receptor (H2CAA71) (also called antagonist or agonist, respectively) from suitably manipulated cells or tissues Standard methods for conducting screening assays are well understood in the art.

Examples of potential Novel 7TM receptor (H2CAA71) antagonists include antibodies or, in some cases, oligonucleotides or proteins which are closely related to the ligand of the Novel 7TM receptor (H2CAA71), e.g., a fragment of the ligand, or small molecules which bind to the receptor but do not elicit a response, so that the activity of the receptor is prevented.

Prophylactic and Therapeutic Methods

This invention provides methods of treating abnormal conditions such as, infections such as bacterial, fungal, protozoan and viral infections, particularly infections caused by HIV-1 or HIV-2; pain; cancers; anorexia; bulimia; asthma; Parkinson's disease; acute heart failure; hypotension; hypertension; urinary retention; osteoporosis; angina pectoris;

myocardial infarction; ulcers; asthma; allergies; benign prostatic hypertrophy; and psychotic and neurological disorders, including anxiety, schizophrenia, manic depression, delirium, dementia, severe mental retardation and dyskinesias, such as Huntington's disease or Gilles dela Tourett's syndrome, related to both an excess of and insufficient amounts of Novel 7TM receptor (H2CAA71) activity.

If the activity of Novel 7TM receptor (H2CAA71) is in excess, several approaches are available. One approach comprises administering to a subject an inhibitor compound (antagonist) as hereinabove described along with a pharmaceutically acceptable carrier in an amount effective to inhibit activation by blocking binding of ligands to the Novel 7TM receptor (H2CAA71), or by inhibiting a second signal, and thereby alleviating the abnormal condition. In another approach, soluble forms of Novel 7TM receptor (H2CAA71) polypeptides still capable of binding the ligand in competition with endogenous Novel 7TM receptor (H2CAA71) may be administered. Typical embodiments of such competitors comprise fragments of the Novel 7TM receptor (H2CAA71) polypeptide.

In still another approach, expression of the gene encoding endogenous Novel 7TM receptor (H2CAA71) can be inhibited using expression blocking techniques. Known such techniques involve the use of antisense sequences, either internally generated or separately administered. See, for example, O'Connor, *J Neurochem* (1991) 56:560 in Oligodeoxynucleotides as Antisense Inhibitors of Gene Expression, CRC Press, Boca Raton, FL (1988). Alternatively, oligonucleotides which form triple helices with the gene can be supplied. See, for example, Lee *et al.*, *Nucleic Acids Res* (1979) 6:3073; Cooney *et al.*, *Science* (1988) 241:456; Dervan *et al.*, *Science* (1991) 251:1360. These oligomers can be administered *per se* or the relevant oligomers can be expressed *in vivo*.

For treating abnormal conditions related to an under-expression of Novel 7TM receptor (H2CAA71) and its activity, several approaches are also available. One approach comprises administering to a subject a therapeutically effective amount of a compound which activates Novel 7TM receptor (H2CAA71), i.e., an agonist as described above, in combination with a pharmaceutically acceptable carrier, to thereby alleviate the abnormal condition. Alternatively, gene therapy may be employed to effect the endogenous production of Novel 7TM receptor (H2CAA71) by the relevant cells in the subject. For example, a polynucleotide of the invention may be engineered for expression in a replication defective retroviral vector, as discussed above. The retroviral expression construct may then be isolated and introduced into a packaging cell transduced with a retroviral plasmid vector containing RNA encoding a polypeptide of the present invention such that the packaging cell now produces infectious viral particles containing the gene of interest. These producer cells may be administered to a subject for engineering cells *in vivo* and expression of the polypeptide *in vivo*. For overview of gene therapy, see Chapter 20, *Gene Therapy and other Molecular Genetic-based Therapeutic Approaches*, (and references cited therein) in Human Molecular Genetics, T Strachan and A P Read, BIOS Scientific Publishers Ltd (1996). Another approach is to administer a therapeutic amount of Novel 7TM receptor (H2CAA71) polypeptides in combination with a suitable pharmaceutical carrier.

Formulation and Administration

Peptides, such as the soluble form of Novel 7TM receptor (H2CAA71) polypeptides, and agonists and antagonist peptides or small molecules, may be formulated in combination with a suitable pharmaceutical carrier. Such formulations comprise a therapeutically effective amount of the polypeptide or compound, and a pharmaceutically acceptable carrier or excipient. Such carriers include but are not limited to, saline, buffered saline, dextrose, water, glycerol, ethanol, and combinations thereof. Formulation should suit the mode of administration, and is well within the skill of the art. The invention further relates to pharmaceutical packs and kits comprising one or more containers filled with one or more of the ingredients of the aforementioned compositions of the invention.

Polypeptides and other compounds of the present invention may be employed alone or in conjunction with other compounds, such as therapeutic compounds.

Preferred forms of systemic administration of the pharmaceutical compositions include injection, typically by intravenous injection. Other injection routes, such as subcutaneous, intramuscular, or intraperitoneal, can be used. Alternative means for systemic administration include transmucosal and transdermal administration using penetrants such as bile salts or fusidic acids or other detergents. In addition, if properly formulated in enteric or encapsulated formulations, oral administration may also be possible. Administration of these compounds may also be topical and/or localized, in the form of salves, pastes, gels and the like.

The dosage range required depends on the choice of peptide, the route of administration, the nature of the formulation, the nature of the subject's condition, and the judgment of the attending practitioner. Suitable dosages, however, are in the range of 0.1-100 μg/kg of subject. Wide variations in the needed dosage, however, are to be expected in view of the variety of compounds available and the differing efficiencies of various routes of administration. For example, oral administration would be expected to require higher dosages than administration by intravenous injection. Variations in these dosage levels can be adjusted using standard empirical routines for optimization, as is well understood in the art.

Polypeptides used in treatment can also be generated endogenously in the subject, in treatment modalities often referred to as "gene therapy" as described above. Thus, for example, cells from a subject may be engineered with a

polynucleotide, such as a DNA or RNA, to encode a polypeptide *ex vivo*, and for example, by the use of a retroviral plasmid vector. The cells are then introduced into the subject.

Examples

The examples below are carried out using standard techniques, which are well known and routine to those of skill in the art, except where otherwise described in detail. The examples illustrate, but do not limit the invention.

Example 1: Gene Cloning

The H2CAA71 EST (# 898510) was identified from the Human Genome Sciences (HGS) database as a potential 7TM receptor and has the following sequence:

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   1   GGCACGAGAA CGCCATCATT AGGATTCACT GTAACGTTAG TGCTATTAAA

  51   CTCACTAGCA TTTTTATTAA TGGCCGTTAT CTACACTAAG CTATACTGCA

 101   ACTTGGAAAA AGAGGACCTC TCAGAAAACT CACAATCTAG CATGATTAAG

 151   CATGTCGCTT GGCTAATCTT CACCAATTGC ATCTTTTTCT GCCCTGTGGC

 201   GTTTTTTTCA TTTGCACCAT TGATCACTGC AATCTCTATC AGCCCCGAAA

 251   TAATGAAGTC TGTTACTCTG ATATTTTTTC CATTGCCTGC TTGCCTGAAT

 301   CCAGTCCTGT ATGTTTTCTT CAACCCAAAG TTTAAAGAGG ACTGGGAAGT

 351   TACTGAGGCG ACGTGTTTAC CAGGAAAAGT GGGTCCAGTT TCAGTTNCCN

 401   CATAGNCCAG GTGGTTTCTG GAACAGGGTT TNTATAGGGT TTGGGATGTA

 451   CTCACATTNG AAGGCAACCT GAC  (SEQ ID NO: 3)
```

This clone was ordered and sequenced completely. Analysis of the sequence revealed that the clone is a truncated clone. Therefore, oligonucleotides (5') were designed at the 5' end of the clone. This oligo was: AGTTAGGATGCCAGTATAGATTCCC (SEQ ID NO:4). This oligo was used to PCR a 1.3 kb 5' fragment using the Marathon technique (Cloneteck). The 5' PCR fragment was subcloned into pCR2.1 vector and were sequenced. This fragment was found to overlap with the original H2CAA71 truncated clone. The full length clone is of 4.2 kb in length and it encodes a protein of 644 amino acids.

Example 2: Mammalian Cell Expression

The receptors of the present invention are expressed in either human embryonic kidney 293 (HEK293) cells or adherent dhfr CHO cells. To maximize receptor expression, typically all 5' and 3' untranslated regions (UTRs) are removed from the receptor cDNA prior to insertion into a pCDN or pCDNA3 vector. The cells are transfected with individual receptor cDNAs by lipofectin and selected in the presence of 400 mg/ml G418. After 3 weeks of selection, individual clones are picked and expanded for further analysis. HEK293 or CHO cells transfected with the vector alone serve as negative controls. To isolate cell lines stably expressing the individual receptors, about 24 clones are typically selected and analyzed by Northern blot analysis. Receptor mRNAs are generally detectable in about 50% of the G418-resistant clones analyzed.

Example 3 Ligand bank for binding and functional assays.

A bank of over 200 putative receptor ligands has been assembled for screening. The bank comprises: transmitters, hormones and chemokines known to act via a human seven transmembrane (7TM) receptor; naturally occurring compounds which may be putative agonists for a human 7TM receptor, non-mammalian, biologically active peptides for which a mammalian counterpart has not yet been identified; and compounds not found in nature, but which activate 7TM receptors with unknown natural ligands. This bank is used to initially screen the receptor for known ligands, using both functional (i.e. calcium, cAMP, microphysiometer, oocyte electrophysiology, etc., see below) as well as binding assays.

Example 4: Ligand Binding Assays

Ligand binding assays provide a direct method for ascertaining receptor pharmacology and are adaptable to a high throughput format. The purified ligand for a receptor is radiolabeled to high specific activity (50-2000 Ci/mmol) for binding studies. A determination is then made that the process of radiolabeling does not diminish the activity of the ligand towards its receptor. Assay conditions for buffers, ions, pH and other modulators such as nucleotides are optimized to establish a workable signal to noise ratio for both membrane and whole cell receptor sources. For these assays, specific receptor binding is defined as total associated radioactivity minus the radioactivity measured in the presence of an excess of unlabeled competing ligand. Where possible more than one competing ligand is used to define residual non-specific binding.

Example 5: Functional Assay in Xenopus Oocytes

Capped RNA transcripts from linearized plasmid templates encoding the receptor cDNAs of the invention are synthesized in vitro with RNA polymerases in accordance with standard procedures. In vitro transcripts are suspended in water at a final concentration of 0.2 mg/ml. Ovarian lobes are removed from adult female toads, Stage V defolliculated oocytes are obtained, and RNA transcripts (10 ng/oocyte) are injected in a 50 nl bolus using a microinjection apparatus. Two electrode voltage clamps are used to measure the currents from individual Xenopus oocytes in response to agonist exposure. Recordings are made in Ca2+ free Barth's medium at room temperature. The Xenopus system can be used to screen known ligands and tissue/cell extracts for activating ligands.

Example 6: Microphysiometric Assays

Activation of a wide variety of secondary messenger systems results in extrusion of small amounts of acid from a cell. The acid formed is largely as a result of the increased metabolic activity required to fuel the intracellular signaling process. The pH changes in the media surrounding the cell are very small but are detectable by the CYTOSENSOR microphysiometer (Molecular Devices Ltd., Menlo Park, CA). The CYTOSENSOR is thus capable of detecting the activation of a receptor which is coupled to an energy utilizing intracellular signaling pathway such as the G-protein coupled receptor of the present invention.

Example 7: Extract/Cell Supernatant Screening

A large number of mammalian receptors exist for which there remains, as yet, no cognate activating ligand (agonist). Thus, active ligands for these receptors may not be included within the ligands banks as identified to date. Accordingly, the 7TM receptor of the invention is also functionally screened (using calcium, cAMP, microphysiometer, oocyte electrophysiology, etc., functional screens) against tissue extracts to identify natural ligands. Extracts that produce positive functional responses can be sequentially subfractionated until an activating ligand is isolated identified.

Example 8: Calcium and cAMP Functional Assays

7TM receptors which are expressed in HEK 293 cells have been shown to be coupled functionally to activation of PLC and calcium mobilization and/or cAMP stimulation or inhibition. Basal calcium levels in the HEK 293 cells in receptor-transfected or vector control cells were observed to be in the normal, 100 nM to 200 nM, range. HEK 293 cells expressing recombinant receptors are loaded with fura 2 and in a single day > 150 selected ligands or tissue/cell extracts are evaluated for agonist induced calcium mobilization. Similarly, HEK 293 cells expressing recombinant receptors are evaluated for the stimulation or inhibition of cAMP production using standard cAMP quantitation assays. Agonists presenting a calcium transient or cAMP fluctuation are tested in vector control cells to determine if the response is unique to the transfected cells expressing receptor.

SEQUENCE LISTING

(1) GENERAL INFORMATION

(i) APPLICANT: SmithKline Beecham Corporation

(ii) TITLE OF THE INVENTION: NOVEL 7TM RECEPTOR (H2CAA71)

(iii) NUMBER OF SEQUENCES: 4

(iv) CORRESPONDENCE ADDRESS:
(A) ADDRESSEE: F J Cleveland & Company
(B) STREET: 40/43 Chancery Lane
(C) CITY: London
(D) STATE: -
(E) COUNTRY: United Kingdom
(F) POST CODE: WC2A 1JQ

(v) COMPUTER READABLE FORM:
(A) MEDIUM TYPE: Diskette
(B) COMPUTER: IBM Compatible
(C) OPERATING SYSTEM: DOS
(D) SOFTWARE: FastSEQ for Windows Version 2.0

(vi) CURRENT APPLICATION DATA:
(A) APPLICATION NUMBER: TO BE ASSIGNED
(B) FILING DATE: 30-MAY-1997
(C) CLASSIFICATION: UNKNOWN

(vii) PRIOR APPLICATION DATA:
(A) APPLICATION NUMBER:
(B) FILING DATE:

(viii) ATTORNEY/AGENT INFORMATION:
(A) NAME: CRUMP, Julian Richard John
(B) REGISTRATION NUMBER: 37127
(C) REFERENCE/DOCKET NUMBER: GH-70055

(ix) TELECOMMUNICATION INFORMATION:
(A) TELEPHONE: +44 171 405 5875
(B) TELEFAX: +44 171 831 0749
(C) TELEX:

(2) INFORMATION FOR SEQ ID NO:1:

(i) SEQUENCE CHARACTERISTICS:
(A) LENGTH: 4203 base pairs
(B) TYPE: nucleic acid
(C) STRANDEDNESS: single
(D) TOPOLOGY: linear
(ii) MOLECULE TYPE: cDNA

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:1:

GCTTCCATCC TAATACAACT CACTATAGGG CTCGAGCGGC CGCCCGGGCA GGTGCTTGAC 60
GGAGGTGCCT GTGCACCCCC TCAGCAATCT GCCCACCCTA CAGGCGCTGA CCCTGGCTCT 120
CAACAAGATC TCAAGCATCC CTGACTTTGC ATTTACCAAC CTTTCAAGCC TGGTAGTTCT 180
GCATCTTCAT AACAATAAAA TTAGAAGCCT GAGTCAACAC TGTTTTGATG GACTAGATAA 240
CCTGGAGACC TTAGACTTGA ATTATAATAA CTTGGGGGAA TTTCCTCAGG CTATTAAAGC 300
CCTTCCTAGC CTTAAAGAGC TAGGATTTCA TAGTAATTCT ATTTCTGTTA TCCCTATGGA 360
GCATTTGATG GTAATCCACT CTTAAGAACT ATACATTTGT ATGATAATCC TCTGTCTTTT 420
GTGGGGAACT CAGCATTTCA CAATTTATCT GATCTTCATT CCCTAGTCAT TCGTGGTGCA 480
AGCATGGTGC AGCAGTTCCC CAATCTTACA GGAACTGTCC ACCTGGAAAG TCTGACTTTG 540
ACAGGTACAA AGATAAGCAG CATACCTAAT AATTTGTGTC AAGAACAAAA GATGCTTAGG 600
ACTTTGGACT TGTCTTACAA TAATATAAGA GACCTTCCAA GTTTTAATGG TTGCCATGCT 660
CTGGAAGAAA TTTCTTTACA GCGTAATCAA ATCTACCAAA TAAAGGAAGG CACCTTTCAA 720
GGCCTGATAT CTCTAAGGAT TCTAGATCTG AGTAGAAACC TGATACATGA AATTCACAGT 780
AGAGCTTTTG CCACACTTGG GCCAATAACT AACCTAGATG TAAGTTTCAA TGAATTAACT 840
TCCTTTCCTA CGGAAGGCCT GAATGGGCTA AATCAACTGA AACTGGTGGG CAACTTCAAG 900
CTGAAAGAAG CCTTAGCAGC AAAAGACTTT GTTAACCTCA GGTCTTTATC AGTACCATAT 960
GCTTATCAGT GCTGTGCATT TTGGGGTTGT GACTCTTATG CAAATTTAAA CACAGAAGAT 1020
AACAGCCTCC AGGACCACAG TGTGGCACAG GAGAAAGGTA CTGCTGATGC AGCAAATGTC 1080
ACAAGCACTC TTGAAAATGA AGAACATAGT CAAATAATTA TCCATTGTAC ACCTTCAACA 1140
GGTGCTTTTA AGCCCTGTGA ATATTTACTG GGAAGCTGGA TGATTCGTCT TACTGTGTGG 1200
TTCATTTTCT TGGTTGCATT ATTTTTCAAC CTGCTTGTTA TTTTAACAAC ATTTGCATCT 1260
TGTACATCAC TGCCTTCGTC CAAATTGTTT ATAGGCTTGA TTTCTGTGTC TAACTTATTC 1320
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TTCTCCTCAG AAAGTGCCAT ATTTTTATTA ATGCTAGCAA CTGTCGAAAG AAGCTTATCT 1500
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TAAAAATTAA AAATTTTACT TGATTCCCAT CTATGGGCTT TAGACCTATT ACTGGGTGGA 3660
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AATTAAACTG TACATACTGT GCATATAATG AATTTTTATC TTATGTAAAT TATTTTTAGA 3840
ACACAAGTTG GGAAATGTGG CTTCTGTTCA TTTCGTTTAA TTAAAGCTAC CTCCTAAACT 3900
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AGTCTTTGTT GTACATTGTC AGTGTAATAA AAACAGAATC TTTGTATATC AAAATCATGT   4020
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TATTTACAAG TTTTAAAAAT TGCTATCATG TATATTTACA CATCTGATAA ATATTAAATC   4140
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AAA                                                                4203
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(2) INFORMATION FOR SEQ ID NO:2:

(i) SEQUENCE CHARACTERISTICS:
(A) LENGTH: 644 amino acids
(B) TYPE: amino acid
(C) STRANDEDNESS: single
(D) TOPOLOGY: linear
(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:2:

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Met Val Gln Gln Phe Pro Asn Leu Thr Gly Thr Val His Leu Glu Ser
 1               5                  10                  15
Leu Thr Leu Thr Gly Thr Lys Ile Ser Ser Ile Pro Asn Asn Leu Cys
            20                  25                  30
Gln Glu Gln Lys Met Leu Arg Thr Leu Asp Leu Ser Tyr Asn Asn Ile
        35                  40                  45
Arg Asp Leu Pro Ser Phe Asn Gly Cys His Ala Leu Glu Glu Ile Ser
    50                  55                  60
Leu Gln Arg Asn Gln Ile Tyr Gln Ile Lys Glu Gly Thr Phe Gln Gly
65                  70                  75                  80
Leu Ile Ser Leu Arg Ile Leu Asp Leu Ser Arg Asn Leu Ile His Glu
                85                  90                  95
Ile His Ser Arg Ala Phe Ala Thr Leu Gly Pro Ile Thr Asn Leu Asp
            100                 105                 110
Val Ser Phe Asn Glu Leu Thr Ser Phe Pro Thr Glu Gly Leu Asn Gly
        115                 120                 125
Leu Asn Gln Leu Lys Leu Val Gly Asn Phe Lys Leu Lys Glu Ala Leu
    130                 135                 140
Ala Ala Lys Asp Phe Val Asn Leu Arg Ser Leu Ser Val Pro Tyr Ala
145                 150                 155                 160
Tyr Gln Cys Cys Ala Phe Trp Gly Cys Asp Ser Tyr Ala Asn Leu Asn
                165                 170                 175
Thr Glu Asp Asn Ser Leu Gln Asp His Ser Val Ala Gln Glu Lys Gly
            180                 185                 190
Thr Ala Asp Ala Ala Asn Val Thr Ser Thr Leu Glu Asn Glu Glu His
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        195                 200                 205
Ser Gln Ile Ile Ile His Cys Thr Pro Ser Thr Gly Ala Phe Lys Pro
    210                 215                 220
Cys Glu Tyr Leu Leu Gly Ser Trp Met Ile Arg Leu Thr Val Trp Phe
225                 230                 235                 240
Ile Phe Leu Val Ala Leu Phe Phe Asn Leu Leu Val Ile Leu Thr Thr
                245                 250                 255
Phe Ala Ser Cys Thr Ser Leu Pro Ser Ser Lys Leu Phe Ile Gly Leu
            260                 265                 270
Ile Ser Val Ser Asn Leu Phe Met Gly Ile Tyr Thr Gly Ile Leu Thr
        275                 280                 285
Phe Leu Asp Ala Val Ser Trp Gly Arg Phe Ala Glu Phe Gly Ile Trp
    290                 295                 300
Trp Glu Thr Gly Ser Gly Cys Lys Val Thr Gly Phe Leu Ala Val Phe
305                 310                 315                 320
Ser Ser Glu Ser Ala Ile Phe Leu Leu Met Leu Ala Thr Val Glu Arg
                325                 330                 335
Ser Leu Ser Ala Lys Asp Ile Met Lys Asn Gly Lys Ser Asn His Leu
            340                 345                 350
Lys Gln Phe Arg Val Ala Ala Leu Leu Ala Phe Leu Gly Ala Thr Val
        355                 360                 365
Thr Gly Cys Phe Pro Leu Phe His Arg Gly Glu Tyr Ser Ala Ser Pro
    370                 375                 380
Leu Cys Leu Pro Phe Pro Thr Gly Glu Thr Pro Ser Leu Gly Phe Thr
385                 390                 395                 400
Val Thr Leu Val Leu Leu Asn Ser Leu Ala Phe Leu Leu Met Ala Val
                405                 410                 415
Ile Tyr Thr Lys Leu Tyr Cys Asn Leu Glu Lys Glu Asp Leu Ser Glu
            420                 425                 430
Asn Ser Gln Ser Ser Met Ile Lys His Val Ala Trp Leu Ile Phe Thr
        435                 440                 445
Asn Cys Ile Phe Phe Cys Pro Val Ala Phe Phe Ser Phe Ala Pro Leu
    450                 455                 460
Ile Thr Ala Ile Ser Ile Ser Pro Glu Ile Met Lys Ser Val Thr Leu
465                 470                 475                 480
Ile Phe Phe Pro Leu Pro Ala Cys Leu Asn Pro Val Leu Tyr Val Phe
                485                 490                 495
Phe Asn Pro Lys Phe Lys Glu Asp Trp Lys Leu Leu Lys Arg Arg Val
            500                 505                 510
Thr Lys Lys Ser Gly Ser Val Ser Val Ser Ile Ser Ser Gln Gly Gly
        515                 520                 525
Cys Leu Glu Gln Asp Phe Tyr Tyr Asp Cys Gly Met Tyr Ser His Leu
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    530                 535                 540
Gln Gly Asn Leu Thr Val Cys Asp Cys Cys Glu Ser Phe Leu Leu Thr
545                 550                 555                 560
Lys Pro Val Ser Cys Lys His Leu Ile Lys Ser His Ser Cys Pro Ala
                565                 570                 575
Leu Ala Val Ala Ser Cys Gln Arg Pro Glu Gly Tyr Trp Ser Asp Cys
            580                 585                 590
Gly Thr Gln Ser Ala His Ser Asp Tyr Ala Asp Glu Glu Asp Ser Phe
        595                 600                 605
Val Ser Asp Ser Ser Asp Gln Val Gln Ala Cys Gly Arg Ala Cys Phe
    610                 615                 620
Tyr Gln Ser Arg Gly Phe Pro Leu Val Arg Tyr Ala Tyr Asn Leu Pro
625                 630                 635                 640
Arg Val Lys Asp
```

(2) INFORMATION FOR SEQ ID NO:3:

(i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 473 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:3:

```
GGCACGAGAA CGCCATCATT AGGATTCACT GTAACGTTAG TGCTATTAAA CTCACTAGCA     60
TTTTTATTAA TGGCCGTTAT CTACACTAAG CTATACTGCA ACTTGGAAAA AGAGGACCTC    120
TCAGAAAACT CACAATCTAG CATGATTAAG CATGTCGCTT GGCTAATCTT CACCAATTGC    180
ATCTTTTTCT GCCCTGTGGC GTTTTTTTCA TTTGCACCAT TGATCACTGC AATCTCTATC    240
AGCCCCGAAA TAATGAAGTC TGTTACTCTG ATATTTTTTC CATTGCCTGC TTGCCTGAAT    300
CCAGTCCTGT ATGTTTTCTT CAACCCAAAG TTTAAAGAGG ACTGGGAAGT TACTGAGGCG    360
ACGTGTTTAC CAGGAAAAGT GGGTCCAGTT TCAGTTNCCN CATAGNCCAG GTGGTTTCTG    420
GAACAGGGTT TNTATAGGGT TTGGGATGTA CTCACATTNG AAGGCAACCT GAC           473
```

(2) INFORMATION FOR SEQ ID NO:4:

(i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 25 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:4:

AGTTAGGATG CCAGTATAGA TTCCC 25

Claims

1. An isolated polynucleotide comprising a nucleotide sequence that has at least 80% identity to a nucleotide sequence encoding the Novel 7TM receptor (H2CAA71) polypeptide of SEQ ID NO:2 over its entire length; or a nucleotide sequence complementary to said isolated polynucleotide.

2. The polynucleotide of claim 1 which is DNA or RNA.

3. The polynucleotide of claim 1 wherein said polynucleotide comprises a nucleotide sequence that has at least 80% identical to that of SEQ ID NO:1 over its entire length.

4. The polynucleotide of claim 3 wherein said nucleotide sequence comprises the Novel 7TM receptor (H2CAA71) polypeptide encoding sequence contained in SEQ ID NO:1.

5. The polynucleotide of claim 3 which is polynucleotide of SEQ ID NO: 1.

6. A DNA or RNA molecule comprising an expression system, wherein said expression system is capable of producing a Novel 7TM receptor (H2CAA71) polypeptide comprising an amino acid sequence, which has at least 80% identity with the polypeptide of SEQ ID NO:2 when said expression system is present in a compatible host cell.

7. A host cell comprising the expression system of claim 6.

8. A process for producing a Novel 7TM receptor (H2CAA71) polypeptide comprising culturing a host of claim 7 under conditions sufficient for the production of said polypeptide and recovering the polypeptide from the culture.

9. A process for producing a cell which produces a Novel 7TM receptor (H2CAA71) polypeptide thereof comprising transforming or transfecting a host cell with the expression system of claim 6 such that the host cell, under appropriate culture conditions, produces a Novel 7TM receptor (H2CAA71) polypeptide.

10. A Novel 7TM receptor (H2CAA71) polypeptide comprising an amino acid sequence which is at least 80% identical to the amino acid sequence of SEQ ID NO:2 over its entire length.

11. The polypeptide of claim 10 which comprises the amino acid sequence of SEQ ID NO:2.

12. An antibody immunospecific for the Novel 7TM receptor (H2CAA71) polypeptide of claim 10.

13. A method for the treatment of a subject in need of enhanced activity or expression of Novel 7TM receptor (H2CAA71) polypeptide of claim 10 comprising:

    (a) administering to the subject a therapeutically effective amount of an agonist to said receptor; and/or
    (b) providing to the subject an isolated polynucleotide comprising a nucleotide sequence that has at least 80% identity to a nucleotide sequence encoding the Novel 7TM receptor (H2CAA71) polypeptide of SEQ ID NO:2 over its entire length; or a nucleotide sequence complementary to said nucleotide sequence in a form so as to effect production of said polypeptide activity *in vivo*.

14. A method for the treatment of a subject having need to inhibit activity or expression of Novel 7TM receptor

(H2CAA71) polypeptide of claim 10 comprising:

(a) administering to the subject a therapeutically effective amount of an antagonist to said receptor; and/or
(b) administering to the subject a nucleic acid molecule that inhibits the expression of the nucleotide sequence encoding said receptor; and/or
(c) administering to the subject a therapeutically effective amount of a polypeptide that competes with said receptor for its ligand.

15. A process for diagnosing a disease or a susceptibility to a disease in a subject related to expression or activity of Novel 7TM receptor (H2CAA71) polypeptide of claim 10 in a subject comprising:

(a) determining the presence or absence of a mutation in the nucleotide sequence encoding said Novel 7TM receptor (H2CAA71) polypeptide in the genome of said subject; and/or
(b) analyzing for the presence or amount of the Novel 7TM receptor (H2CAA71) polypeptide expression in a sample derived from said subject.

16. A method for identifying agonists to Novel 7TM receptor (H2CAA71) polypeptide of claim 10 comprising:

(a) contacting a cell which produces a Novel 7TM receptor (H2CAA71) polypeptide with a candidate compound; and
(b) determining whether the candidate compound effects a signal generated by activation of the Novel 7TM receptor (H2CAA71) polypeptide.

17. An agonist identified by the method of claim 16.

18. A method for identifying antagonists to Novel 7TM receptor (H2CAA71) polypeptide of claim 10 comprising:

(a) contacting a cell which produces a Novel 7TM receptor (H2CAA71) polypeptide with an agonist; and
(b) determining whether the signal generated by said agonist is diminished in the presence of a candidate compound.

19. An antagonist identified by the method of claim 18.